



# Consistent Fuel-Use Accounting at CNG Fueling Stations

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Presented to



January 28, 2003

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# Outline

- Background
- Field Site
- Results
- Future





# Acknowledgments

- Sponsors
  - NGV-IWG (DOE, GTI)
  - South Coast Air Quality Management District
  - Southern California Gas Company
- Project Team
  - Energy International
  - Burnett and Burnette
  - Architectural Energy Corporation
- In-Kind Support
  - Micro Motion
  - Measurement Control Systems



# Project Overview

- Problem
  - Discrepancies in fuel use often exceed 10% at CNG fueling stations
- Objectives
  - Determine why discrepancies exist
  - Provide recommendations that will mitigate discrepancies
  - Achieve discrepancy below 4%

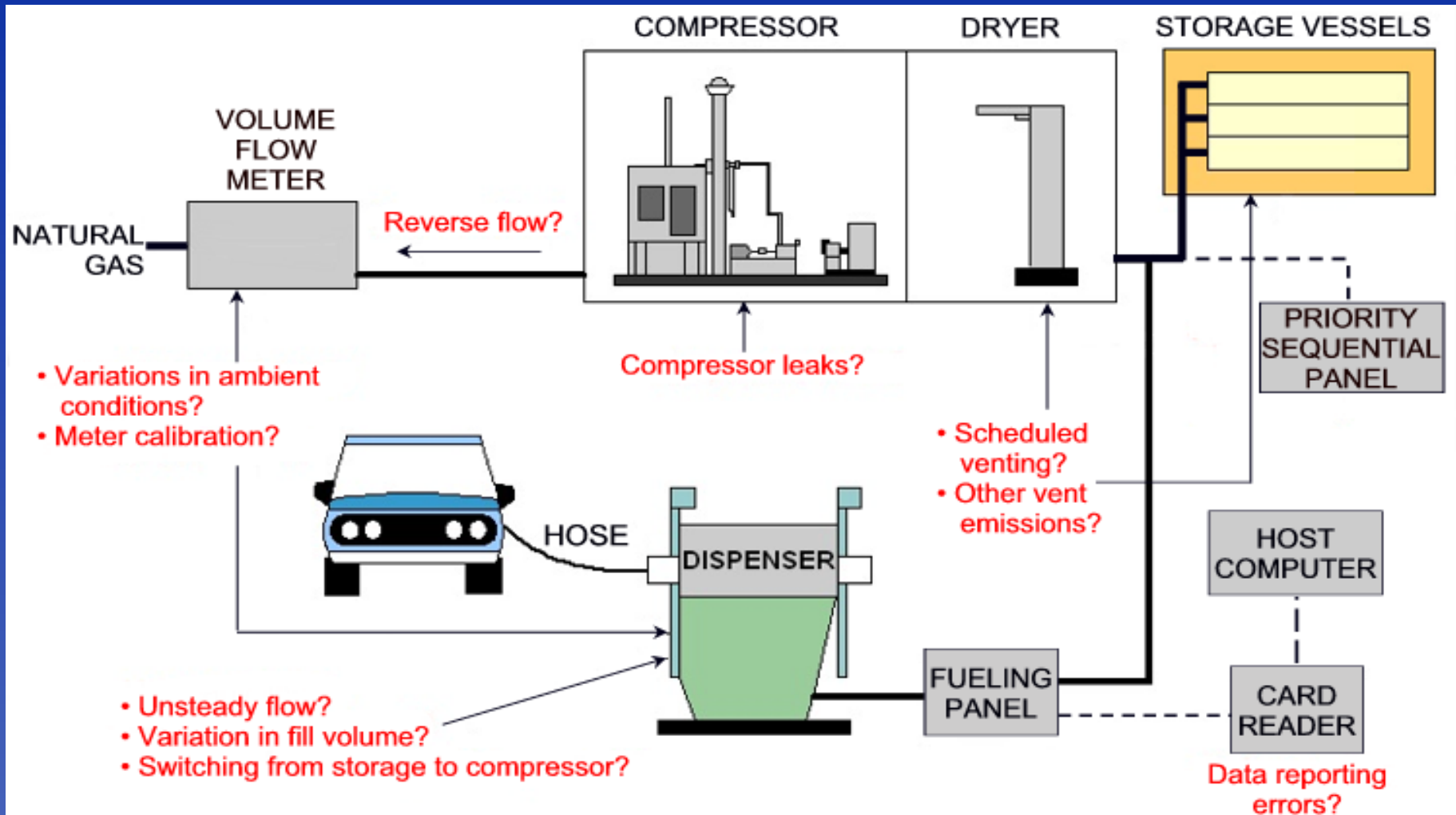


# Field Site – Host CNG Station



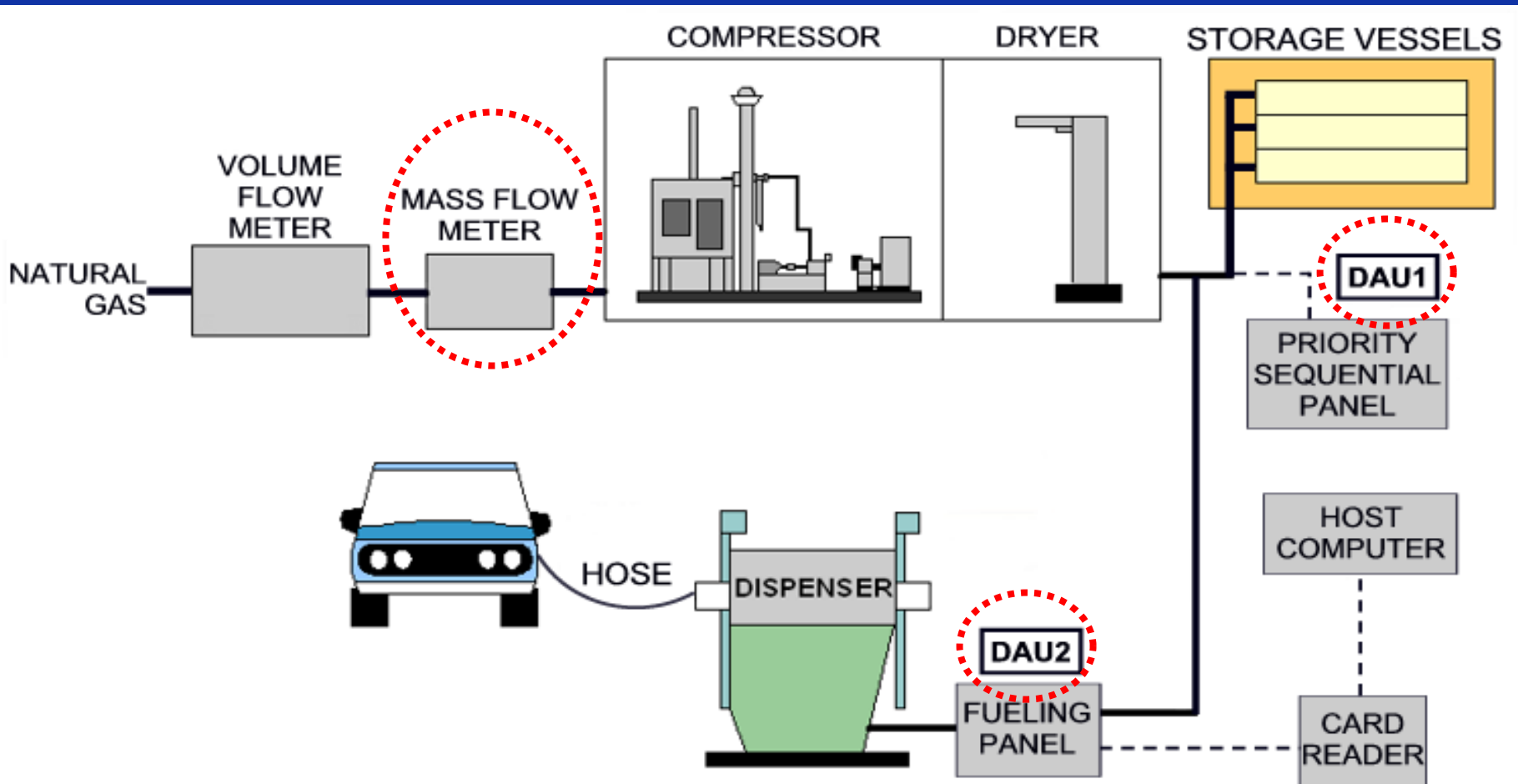
- Consistent fuel discrepancy (loss) near 10%
- Usage
  - ~30,000 gge/month
  - 225 scfm compressor
- Public access
  - taxis
  - city buses
  - various fleet vehicles

# Potential Discrepancy Sources





# Instrumentation for Field Test



..... Added for Field Test



# Meter Set Assembly (MSA)

- Added temperature correction (original MSA had P correction, but not T correction)



Front view



Rear view





# Added Mass Flow Meter

- Micro Motion Elite mass flow meter installed on the gas inlet pipe leading to compressor





# Dispenser Meter Reporting

Micro Motion  
mass flow meter



Measures mass in pounds and sends pulses per pound

Kraus Micon 500  
Head



Converts pulses per pound to gge for display and sends pulses per gge

Ward Cardreader



Counts pulses and writes ASCII report file



# Cardreader Reports

Date	Time	ID	Pump	CCF	GGE
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9/12/2001	10:15	2352560	1	4.3	3.81
9/12/2001	10:20	2352560	1	4.1	3.63
9/12/2001	10:32	21594	1	13.2	11.68
9/12/2001	10:33	18591	2	5.5	4.87
9/12/2001	10:45	21595	2	10.8	9.56
9/12/2001	10:47	21151	1	12.8	11.33
9/12/2001	10:57	16676	1	11.1	9.82
9/12/2001	10:58	21595	2	11.4	10.09
9/12/2001	11:03	21719	1	5.7	5.04
9/12/2001	11:13	21594	2	17.3	15.31
9/12/2001	11:17	19635	2	2.2	1.95
9/12/2001	11:26	16305	1	6.2	5.49



# Compressor Vents

- Balloons (red) on vents from compressor housing and storage vessels





# Qualitative Results

- Station was well-maintained
  - No fugitive leaks detected
- Meters properly calibrated
  - Utility meter (inlet)
  - Dispenser meters (outlet)
- Venting of natural gas was minimal
  - Pressure relief valve on high-pressure storage vessel popped 2-3 times



# Quantitative Metering Data – 6 Sources

## Gas entering station

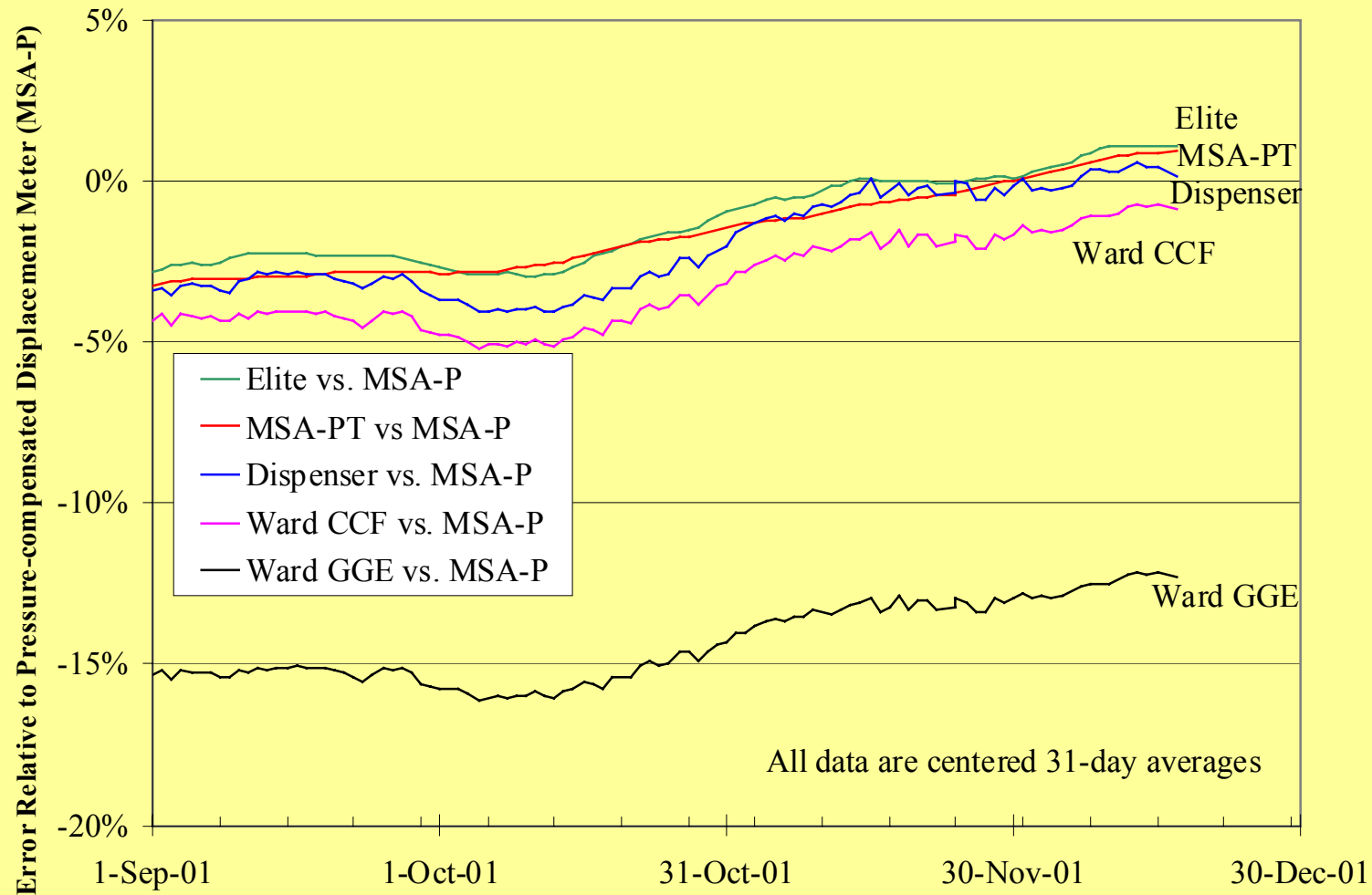
1. Pressure-corrected volume flow
2. Pressure- and temperature-corrected volume flow (new device)
3. Mass flow (new device)

## Gas leaving station (at dispensers)

4. Sum of mass delivered at two dispensers
5. GGE column in cardreader report
6. CCF column in cardreader report

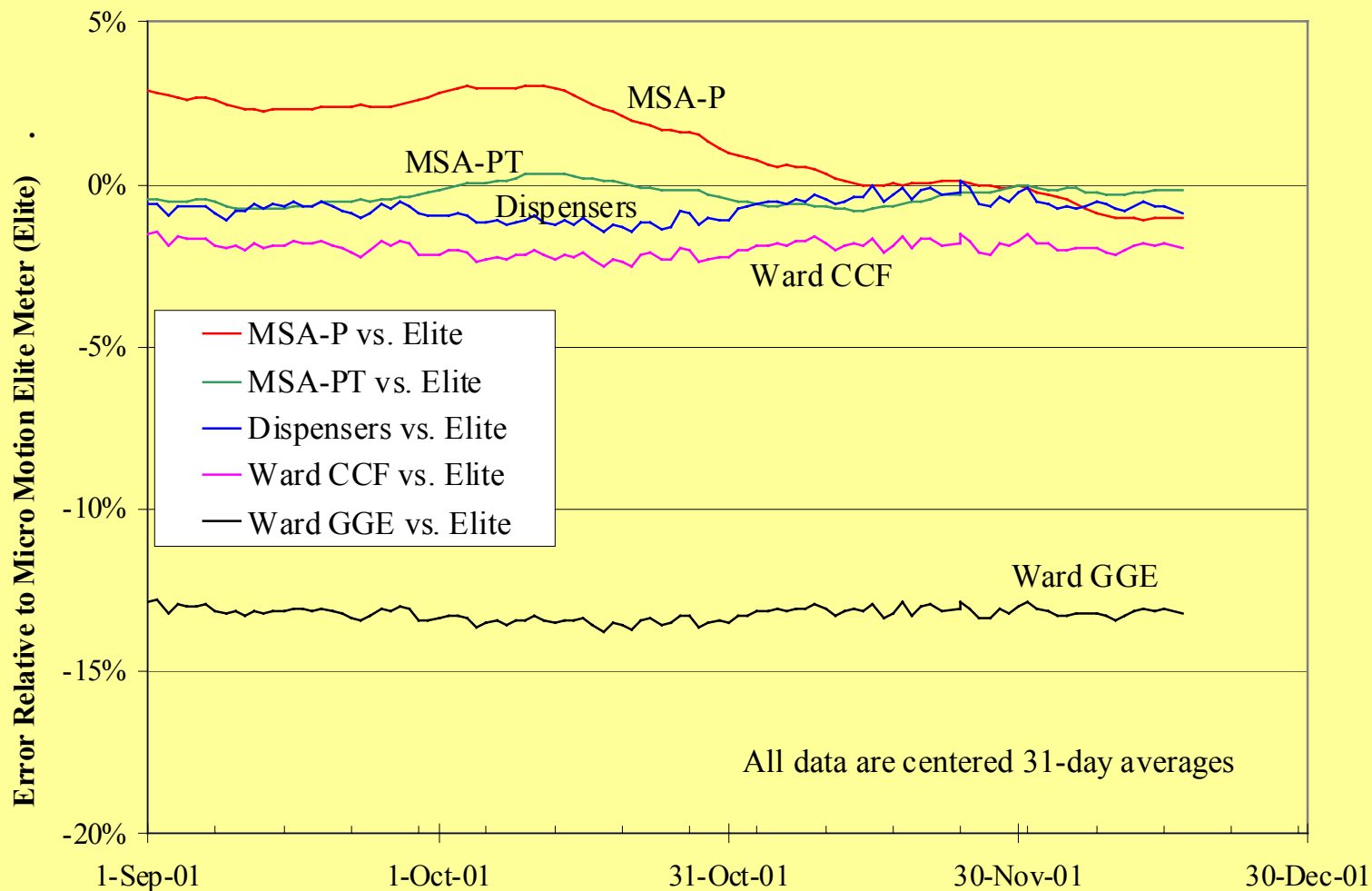


# Metering Data Referenced to Pressure-corrected MSA





# Metering Data Referenced to Micro Motion Elite







# Summary of Results

Source of Discrepancy	Magnitude of Discrepancy	Solution
P-corrected utility meter	-1% to +3% (seasonal)	Add temperature correction
Cardreader report (CCF)	-1%	Increase significant digits (0.01)
Cardreader report (GGE)	-11.5%	Properly label CCF as GGE



# Recommendations

- Good maintenance is essential
  - Perform regular leak checks
  - Recalibrate supply and dispenser meters periodically
- Minimize equipment errors
  - Include P&T corrections on supply meter or consider using a mass flow meter
  - Recapture/contain gas from compressor crankcase
    - Pressurized crankcase
    - Recycle to gas engine drive
  - Report transactions to the nearest 0.01 gge in cardreader report



# Recommendations *continued ...*

- Minimize system errors
  - Compare synchronized utility meter and dispenser meter readings every month
  - Check data processing system for dispensers
    - **Ensure correct conversion factors are used**
    - **Compare time and quantity of each dispenser recalibration test to corresponding line items appearing in detailed billing records**



# Summary

- One Station has been Evaluated
  - Fast fill station
  - Temperate climate (southern California)
- Results have been Reported
  - GTI Report (April 2002)
  - SCAQMD Report (June 2002)
  - Presentation at World NGV2002 Conference (October 2002)



# Future Testing

- Suggest that additional stations be evaluated
  - Improve confidence in results
    - Better statistical basis for conclusions
  - Analyze diversity
    - Climate
    - Altitude
    - Capacity (e.g., transit type station)



# Possible Host Sites for Future Tests

- Have approached several potential host sites
- Received positive responses
- Need approval from sponsors to move forward with host site discussions



# Schedule and Budget (per station)

- 9 months (estimated)
  - 2 months planning and set-up
  - 6 months data collection
  - 1 month analysis and reporting
- \$100,000 (estimated)

# For More Information

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